PATENT ABSTRACTS OF JAPAN

(11)Publication number : 11-065295
(43)Date of publication of application : 05.03.1999

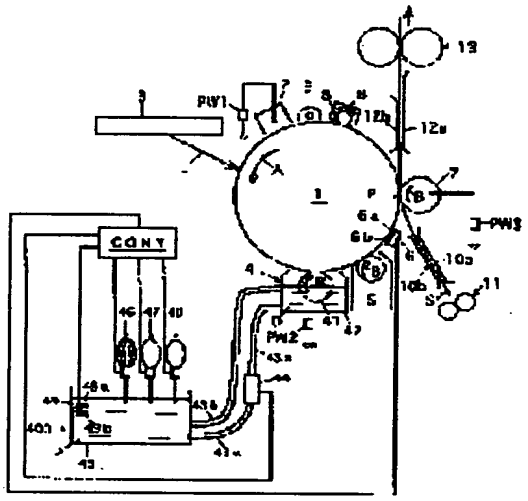
(51)Int.Cl. G03G 15/11

(21)Application number : 09-220295
(22)Date of filing : 15.08.1997

(71)Applicant : MINOLTA CO LTD
(72)Inventor : KANAZAWA MASAHARU

(54) IMAGE FORMING DEVICE

(57)Abstract:
PROBLEM TO BE SOLVED: To stably obtain a satisfactory image by controlling, based on a detected toner-image-density by an optical reflection-density-detection means, so that a charge-control agent in liquid developer is maintained at a proper concentration.
SOLUTION: From the light emission part 6a of the reflection-type photosensor 6, light irradiates a toner image for optical reflection-density- detection formed on a photoreceptor 1, and the reflected light from the toner image is received by a light receiving part 6b. Thus, the density of the toner image on the photoreceptor 1 is detected. A control part CONT compares a given reflection-density reference value (a given reference voltage) and the detection value (output voltage) of the sensor 6. When the detection value is lower than the given reference value, it judges that the density of toner image used for the density detection is higher than a proper density. Accordingly it transmits a signal to a charge-control-agent supply device 47 and make the device 47 supply the charge control agent to the liquid developer D. On the other hand, when the detection value of the sensor 6 is higher than the specific reference value, liquid carrier is supplied to the liquid developer D from the liquid-carrier supply device 48.



LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

CLAIMS

[Claim(s)]
[Claim 1] Negatives are developed using the liquid development agent containing the electric charge control agent for giving a charge for the electrostatic latent image formed on electrostatic latent-image support into carrier liquid at a toner particle and this toner particle. Light is irradiated at the toner image for optical reflection density detection which is image formation equipment which imprints the obtained visible image to a transferred object, and is formed in one of members. An optical reflection density detection means to detect the concentration of this toner image based on the reflected light reflected from this toner image, Image formation equipment characterized by having the electric charge control agent concentration control means controlled to maintain the concentration of the electric charge control agent in said liquid development agent at proper concentration based on said toner image concentration detected by said optical reflection density detection means.
[Claim 2] For this luminescence means and a light-receiving means, said optical reflection density detection means is image formation equipment according to claim 1 which has attended said electrostatic latent-image support so that the concentration of said toner image for optical reflection density detection formed on said electrostatic latent-image support may be detected including a luminescence means and a light-receiving means.

[Claim 3] For this luminescence means and a light-receiving means, said optical reflection density detection means is image formation equipment according to claim 1 which has attended the migration path of said transferred object so that the concentration of said toner image for optical reflection density detection formed on said transferred object may be detected, and is formed in the downstream from the imprint field in this transferred object migration direction including a luminescence means and a light-receiving means.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention develops an electrostatic latent image using a liquid development agent, and relates to image formation equipments imprinted to a transferred object, such as a copying machine and a printer.
[0002]
[Description of the Prior Art] When carrying out image formation using a liquid development agent, in image formation equipments, such as a copying machine and a printer, generally Electrify electrostatic latent-image support front faces, such as a photo conductor, and based on image information, carry out image exposure, and an electrostatic latent image is formed in the electrification region. That latent image is developed using a liquid development agent, and it considers as a visible toner image, this toner image is imprinted to record material, such as direct paper, or the 1st order is once imprinted to a middle imprint member, and you imprint the 2nd order to record material, and make it further fixed to it.
[0003] Generally the liquid development agent contains a toner, an electric charge control agent, and carrier liquid. Usually, a toner consists of colored resin and an electric charge control agent gives a charge to this toner. A toner and an electric charge control agent are distributed by carrier liquid, and these are adjusted to respectively proper concentration so that an electrostatic latent image can be developed in a good toner image. This liquid development agent is supplied to the electrostatic latent image formed on electrostatic latent-image support from liquid development equipment, and an electrostatic latent image carries out electrostatic adsorption of the toner to which the charge was given by the electric charge control agent, and turns into a visible image. A toner and an electric charge control agent are consumed by this, and the toner in a developer and the concentration of an electric charge control agent fall by it. When such concentration falls (change), the concentration of the amount of development of toners, i.e., the amount with which development is presented, and the toner image which will be obtained by development if it puts in another way changes. By change of this amount of development, between the developed images, it will carry out that the variation in concentration occurs etc., and a poor image will be invited. In order to obtain a good image without such concentration variation, when developing an electrostatic latent image, it is necessary to maintain at a proper value the amount of development by the developer with which development is presented. For that purpose, it is necessary to maintain the toner in a developer, and the concentration of an electric charge control agent at proper concentration.
[0004] Since the amount of the toner consumed by development and an electric charge control agent changes with classes (an alphabetic character image, photograph, etc.) of image to develop, it is desirable to control by things for which the concentration of a toner and an electric charge control agent is detected periodically, such as every development, to maintain such concentration at proper concentration. When it sees about the approach of detecting the concentration of the here conventional electric charge control agent, there is a method of using the fixed relation between the conductivity of a liquid development agent and the concentration of an electric charge control agent. This detection approach prepares two electrodes into a liquid development agent, impresses an electrical potential difference to those electrodes, measures the conductivity of a developer from the current which flows to the developer between two electrodes, and detects the concentration of the electric charge control agent in a developer based on that measured value.
[0005]
[Problem(s) to be Solved by the Invention] However, by such approach, with this charge, since the toner in the

developer by which it was electrified can be drawn near to the direction of the electrode with which the electrical potential difference of reversed polarity was impressed and adheres to this electrode surface, it bars the conductivity of a current which flows to this electrode. For this reason, the current which flows between two electrodes changes and there is a problem that the concentration of an electric charge control agent is correctly undetectable. In order to solve it, it is necessary to prepare the electrode cleaning system which cleans it about the electrode to which a toner adheres or, and a serviceman etc. needs to clean periodically the electrode to which a toner adheres. However, when an electrode cleaning system is prepared, complication, a cost rise, etc. of image formation equipment will be caused so much. Moreover, when performing a cleaning maintenance periodically, the increment in maintenance burdens, such as a serviceman, will be caused.

[0006] Then, this invention is image formation equipment developed using the liquid development agent containing the electric charge control agent for giving a charge for the electrostatic latent image formed on electrostatic latent-image support into carrier liquid at a toner particle and this toner particle. Without needing the special means and special maintenance for removing toner adhesion in an electrode like [in the case of preparing an electrode into a liquid development agent like before, and measuring conductivity] in detecting the concentration of an electric charge control agent Let it be a technical problem to offer the image formation equipment which can detect the concentration of an electric charge control agent correctly, can maintain the concentration of an electric charge control agent proper by that cause, and can obtain a good image stably.

[0007]

[Means for Solving the Problem] In order to solve said technical problem the image formation equipment of this invention Negatives are developed using the liquid development agent containing the electric charge control agent for giving a charge for the electrostatic latent image formed on electrostatic latent-image support into carrier liquid at a toner particle and this toner particle. Light is irradiated at the toner image for optical reflection density detection which is image formation equipment which imprints the obtained visible image to a transferred object, and is formed in one of members. An optical reflection density detection means to detect the concentration of this toner image based on the reflected light reflected from this toner image, It is characterized by having the electric charge control agent concentration control means controlled to maintain the concentration of the electric charge control agent in said liquid development agent at proper concentration based on said toner image concentration detected by said optical reflection density detection means.

[0008] In this image formation equipment, said optical reflection density detection means detects the concentration of said toner image for optical reflection density detection. Said electric charge control agent concentration control means is controlled to maintain the concentration of the electric charge control agent in said liquid development agent at proper concentration based on the toner image concentration by this detection. Therefore, without needing the special means and special maintenance for removing toner adhesion in this electrode like [in the case of preparing an electrode into a liquid development agent for electric charge control agent concentration detection, and measuring conductivity], the concentration of an electric charge control agent can be detected correctly, the concentration of an electric charge control agent can be maintained proper by that cause, and a good image can be obtained stably.

[0009] Said optical reflection density detection means to detect the concentration of the toner image for concentration detection formed in said one of members can mention what detects the concentration of this toner image formed on said electrostatic latent-image support, for example, and the thing which detects the concentration of this toner image formed on said transferred object. If it furthermore says, said optical reflection density detection means For example, the concentration of said toner image for optical reflection density detection with which this luminescence means and a light-receiving means are formed on said electrostatic latent-image support including a luminescence means and a light-receiving means, Said electrostatic latent-image support is attended so that the concentration of the toner image which was said toner image for optical reflection density detection formed on said electrostatic latent-image support still more preferably, passed squeeze equipment and was removed in excessive carrier liquid may be detected. In this case, a luminescence means and a light-receiving means are formed in the upstream by the downstream and the imprint field from an electrostatic latent-image development field for example, in this image support surface migration direction. Moreover, including a luminescence means and a light-receiving means, this luminescence means and the light-receiving means have attended the migration path of said transferred object, and can illustrate what is prepared in the downstream from the imprint field in this transferred object migration direction so that the concentration of said toner image for optical reflection density detection formed on said transferred object may be detected.

[0010] In addition, with said transferred object, middle imprint objects, such as record material, such as paper,

and á middle imprint belt, a middle imprint drum, etc. can be mentioned. About detection of the concentration of said toner image for concentration detection by said optical reflection density detection means For example, form the criteria toner image of proper concentration on electrostatic latent-image support or a transferred object beforehand, and the concentration of the toner image is detected. What is necessary is to make this into definite criteria concentration, to, form the toner image for concentration detection on electrostatic latent-image support or a transferred object periodically on the other hand, and just to carry out by measuring the concentration of the toner image, and the definite criteria concentration of said criteria toner image. In this case, the toner image concentration detected from the formed toner image for concentration detection does not restrict that it is in agreement with the definite criteria concentration of a criteria toner image, but when not in agreement, it should just control the concentration of the electric charge control agent in a liquid development agent.

[0011] About said electric-charge control agent-concentration control means, a thing including an electric charge control agent supply means, for example, supply an electric charge control agent to the liquid development agent with which development is presented, and the control means which controls this electric charge control agent supply means to maintain the electric charge control agent concentration in this liquid development agent to proper concentration based on the concentration of said toner image for concentration detection detected by said optical reflection density detection means can be mentioned.

[0012] Moreover, an electric charge control agent supply means to supply an electric charge control agent to the liquid development agent by which development is presented with an electric charge control agent concentration control means, A carrier liquid supply means to supply carrier liquid to this liquid development agent, The control means which controls this electric charge control agent supply means and a carrier liquid supply means to maintain the electric charge control agent concentration in liquid development to proper concentration based on the concentration of said toner image for concentration detection detected by said optical reflection density detection means may be included.

[0013] Among these, also in which electric charge control agent concentration control means, when the electric charge control agent concentration in a liquid development agent is too low, an electric charge control agent is supplied from an electric charge control agent supply means. According to the latter electric charge control agent concentration control means, when the electric charge control agent concentration in a liquid development agent is too high, carrier liquid is supplied from a carrier liquid supply means. In addition, this image formation equipment of the ability to have a means to control a means to detect the toner concentration in a liquid development agent, and the toner concentration in a liquid development agent is natural.

[0014] An optical transmission density detection means to detect the toner concentration in this liquid development agent from the transmitted light which irradiates light at said liquid development agent, and penetrates this liquid development agent as this toner concentration detection means can be illustrated. In this case, the toner concentration control means controlled to maintain the concentration of the toner in said liquid development agent at proper concentration as a toner concentration control means based on the toner concentration detected by this optical transmission density detection means can be mentioned.

[0015] What is necessary is to prepare the criteria liquid development agent of proper toner concentration for example beforehand, to make into definite criteria concentration toner concentration detected from this criteria liquid development agent, to, detect the concentration of the toner in a liquid development agent periodically on the other hand, and just to carry out by measuring the toner concentration and said definite criteria concentration about detection of the toner concentration in said liquid development agent by said optical transmission density detection means. In this case, the concentration of the toner detected from a liquid development agent does not restrict that it is in agreement with criteria toner concentration, but when not in agreement, it should just control the concentration of the toner in a liquid development agent.

[0016] About a toner concentration control means, a thing including a toner supply means (for example, supply means of the concentrated liquid which is concentration toner content liquid) supply a toner to the liquid development agent with which development is presented for example, and the control means which controls this toner supply means to maintain the toner concentration in this liquid development to predetermined proper concentration based on the toner concentration in a liquid development agent detected by said optical transmission density detection means can be mentioned.

[0017] Moreover, a toner supply means to supply a toner to the liquid development agent by which development is presented with a toner concentration control means (for example, supply means of the concentrated liquid which is concentration toner content liquid), A carrier liquid supply means to supply carrier liquid to this liquid

development agent, The control means which controls this toner supply means and a carrier liquid supply means to maintain the toner concentration in liquid development to proper concentration based on the toner concentration in a liquid development agent detected by said optical transmission density detection means may be included.

[0018] Among these, also in which toner concentration control means, when the toner concentration in a liquid development agent is too low, a toner is supplied from a toner supply means. According to the latter toner concentration control means, when the toner concentration in a liquid development agent is too high, carrier liquid is supplied from a carrier liquid supply means.

[0019]

[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained with reference to a drawing. Drawing 1 is the outline block diagram of the image formation equipment which is 1 operation gestalt of this invention. The image formation equipment shown in drawing 1 is image formation equipment of an electrophotography method, and is equipped with the photo conductor 1 (one example of electrostatic latent-image support) of a drum configuration in the center. Around the photo conductor 1, electrification equipment 2, an aligner 3, liquid development equipment 4, the squeeze roller 5, the reflective mold photosensor 6 (one section of one example of an optical reflection density detection means), the imprint roller 7, the cleaner 8, and the eraser lamp 9 are arranged at this order.

[0020] The rotation drive of the photo conductor 1 is carried out at the counterclockwise rotation A in drawing. Although the photo conductor 1 here is a drum-like photo conductor drum, the photo conductor belt of a belt configuration etc. is sufficient as it. The imprint roller 7 attends a photo conductor 1, and forms the imprint section P among drawing. Guide plates 10a and 10b and timing roller pair 11 are prepared in the method of drawing Nakashita of the imprint section P, and the feed section which omitted illustration further is prepared. Moreover, up, guide plates 12a and 12b and a fixing assembly 13 are formed one by one, and the discharge roller pair and paper output tray which omitted illustration further are prepared.

[0021] Electrification equipment 2 can impress the high voltage from a power source PW1, and, thereby, can electrify a photo conductor 1. An aligner 3 can irradiate laser beam L at a photo conductor 1 based on the image information sent from the image reader which omitted illustration, and, thereby, can form an electrostatic latent image on a photo conductor 1.

[0022] Liquid development equipment 4 contains the developing roller 41 and the developer tub 42, and holds the liquid development agent D. A rotation drive is carried out and a developing roller 41 can impress development bias voltage to the clockwise rotation B in drawing from a power source PW2. Thereby, the electrostatic latent image on a photo conductor 1 can be developed. Contact arrangement is carried out at a photo conductor 1, and the rotation drive of the squeeze roller 5 is carried out in the direction of B in drawing with rotation of a photo conductor 1. The carrier liquid which adhered on the photo conductor 1 by this is removable to the specified quantity. In addition, among drawing, although the squeeze roller 5 is formed separately [liquid development equipment 4], it may combine in one and it may be formed in liquid development equipment 4 and the same location.

[0023] The reflective mold photosensor 6 irradiates light at the toner image for optical reflection density detection which is formed on a photo conductor 1 from light-emitting part 6a and which is mentioned later including light-emitting part 6a and light sensing portion 6b, and receives the reflected light reflected from this toner image by light sensing portion 6b. Thereby, this toner image concentration on a photo conductor 1 is detectable. A rotation drive can be carried out in the direction of B in drawing, and the imprint roller 7 can impress the electrical potential difference for an imprint from a power source PW3, and can imprint it on the recording paper S which mentions the toner image on a photo conductor 1 later by this.

[0024] A cleaner 8 is a roller type thing, contact arrangement is carried out at a photo conductor 1, and the rotation drive of it is carried out in the direction of B in drawing with rotation of a photo conductor 1. The transfer residual toner which adhered on the photo conductor 1 by this and which remained without the recording paper S imprinting is removable. The eraser lamp 9 can carry out an optical exposure at a photo conductor 1, and, thereby, can carry out optical electric discharge of the charge on a photo conductor 1.

[0025] Moreover, the developer feeder 400 is formed in this image formation equipment. This feeder 400 is connected to the developer tub 42 of liquid development equipment 4 through tube 43a for developer supply, and tube 43b for developer circulation. The pump 44 is formed in the middle of tube 43a for supply. The liquid development agent D is supplied to the developer tub 42 through tube 43a from a feeder 400 with a pump 44. After the development of the electrostatic latent image on a photo conductor 1 is furthermore presented with a

developing roller 41, it returns to a feeder 400 through tube 43b. Thereby, Developer D circulates through between a feeder 400 and a developer 4.

[0026] The developer feeder 400 is equipped with the developer tank 45, the concentrated liquid (concentration toner content liquid) feeder 46, electric charge control agent supply (supply) equipment 47, carrier liquid supply (supply) equipment 48, and the transparency mold photosensor 49. The developer tank 45 holds the liquid development agent D. The concentrated liquid feeder 46, the electric charge control agent feeder 47, and the carrier liquid feeder 48 can supply a toner, an electric charge control agent, and carrier liquid to the developer D of the developer tank 45, respectively. Including light-emitting part 49a and light sensing portion 49b, a sensor 49 irradiates light from light-emitting part 49a at Developer D, receives the transmitted light which penetrates Developer D by light sensing portion 49b, and detects the light transmission nature of Developer D. Thereby, the concentration of the toner in Developer D is detectable.

[0027] Moreover, this image formation equipment is equipped with the control section CONT. This control section is constituted centering on the computer, and includes a part of 1 of one example of an electric charge control agent concentration control means section, and toner concentration control means of one example. The control section CONT is connected to the reflective mold photosensor 6, the concentrated liquid feeder 46, the electric charge control agent feeder 47, the carrier liquid feeder 48, the transparency mold photosensor 49, and the pump 44 as shown in drawing 1 and drawing 4 . A control section CONT can control the toner in a liquid development agent, the concentration of an electric charge control agent, etc. based on the indication signal from the main control section (refer to drawing 4) which controls actuation of the whole image formation equipment. In addition, although prepared separately from said main control section, it includes in these main control circles, and you may make it control a control section CONT.

[0028] Drawing 5 is the more detailed structure explanatory view of said developer feeder 400. The developer feeder 400 is equipped with the developer tank 45, the concentrated liquid feeder 46, the electric charge control agent feeder 47, the carrier liquid feeder 48, and the transparency mold photosensor 49 as stated above. The developer tank 45 holds the liquid development agent D. The concentrated liquid feeder 46 consists of concentrated liquid tank 46a, concentrated liquid feed zone 46b, and concentrated liquid nozzle 46c. Tank 46a holds the toner concentration liquid which condensed the toner, and feed zone 46b is a pump and can supply the toner concentration liquid of tank 46a to the developer D of a tank 45 from nozzle 46c with the indication signal from a control section CONT.

[0029] The electric charge control agent feeder 47 consists of electric charge control agent tank 47a, electric charge control agent feed zone 47b, and electric charge control agent nozzle 47c. Tank 47a holds the electric charge control agent concentration liquid which condensed the electric charge control agent, and feed zone 47b is a pump and can supply the electric charge control agent concentration liquid which condensed the electric charge control agent of tank 47a with the indication signal from a control section CONT from nozzle 47c to the developer D of a tank 45.

[0030] The carrier liquid feeder 48 consists of carrier liquid tank 48a, carrier liquid feed zone 48b, and carrier liquid nozzle 48c. Tank 48a holds carrier liquid, and feed zone 48b is a pump and can supply the carrier liquid of tank 48a to the developer D of a tank 45 from nozzle 48c with the indication signal from a control section CONT. The transparency mold photosensor 49 is formed in the developer tank 45 including light-emitting part 49a and ight sensing portion 49b. A sensor 49 is supported by sensor supporter material 49c, and the whole sensor soaks it in the liquid development agent D. Light is irradiated from light-emitting part 49a, the transmitted light of Developer D is received by light sensing portion 49b, the toner concentration in Developer D is detected, and the detection value (output voltage) is sent to a control section CONT.

[0031] Image formation actuation of the image formation equipment shown in drawing 1 is explained hereafter, and detection of the toner in the liquid development agent by the back reflective mold photosensor 6, the transparency mold photosensor 49, the control section CONT, the developer feeder 400, etc. and the concentration of an electric charge control agent and control are explained in detail. The rotation drive of the photo conductor 1 is carried out, and this image formation equipment is uniformly charged with electrification equipment 2.

[0032] Laser beam L irradiated from the aligner 3 exposes this electrification region, and forms an electrostatic latent image. This electrostatic latent image shifts to liquid development equipment 4 with rotation of a photo conductor 1. With liquid development equipment 4, it is submerged in the liquid development agent D, and Developer D is pumped up with rotation of a developing roller 41, some developing rollers 41 present the electrostatic latent image formed in a photo conductor 1, it develops this on the basis of development bias

voltage impression, and considers as a visible toner image.
[0033] With the squeeze roller 5, excessive carrier liquid is removed and a visible toner image shifts to the imprint section P. In addition, actuation of the developer feeder 400, the reflective mold photosensor 6, etc. is explained a back forge fire. The toner image which shifted to the imprint section P is imprinted by the recording paper S. the recording paper S is sent out from the medium tray which similarly omitted illustration with the feed roller which omitted illustration — having — a timing roller pair — it is sent to 11. Timing roller pair 11 takes the toner image on a photo conductor 1, and a synchronization, and sends out the recording paper S. The recording paper S is supported by guide plates 10a and 10b, and shifts to the imprint section P.
[0034] In the imprint section P, the imprint roller 7 presses the recording paper S in the photo conductor 1 direction from a rear face. The toner image on a photo conductor 1 contacts the recording paper S, by electrical-potential-difference impression from a power source PW3, can be drawn near to a roller 7 side, and is imprinted by the recording paper S. After a toner image imprint, the recording paper S is supported by guide plates 12a and 12b, and is carried to a fixing assembly 13, and the recording paper S is fixed to a toner image here. It is discharged to a paper output tray in the delivery roller pair which omitted the back illustration.
[0035] In addition, although an imprint method here imprints the toner image on a photo conductor 1 on the direct detail paper S, once it imprints the primary toner image on middle imprint objects, such as an imprint drum and an imprint belt, the so-called middle imprint method imprinted to record material may be used for it. Moreover, although what performs the imprint to the recording paper S of a toner image electrostatic here was adopted, it may replace with the imprint roller 7 and the hot printing roller thermally imprinted under a suitable pressure may be adopted.
[0036] Although the toner which remained in the photo conductor 1, without the recording paper S imprinting is held, a cleaner 8 removes this transfer residual toner. Light is irradiated by the photo conductor 1 from the after eraser lamp 9, and optical electric discharge of the charge on a photo conductor 1 is carried out. And the next image formation is equipped with a photo conductor 1. Next, change of the toner in a liquid development agent or the amount of development of the electrostatic latent image by the liquid development agent to change of the concentration of an electric charge control agent is explained, referring to drawing 2 and drawing 3 .
[0037] Drawing 2 is drawing showing one example of the concentration of the toner in a liquid development agent, and the relation of the amount of development, and drawing 3 is drawing showing one example of the concentration of the electric charge control agent in a liquid development agent, and the relation of the amount of development. If the concentration of the toner in the liquid development agent D decreases [as seeming / it / that drawing 2 shows] like, the amount of development will also decrease. That is, if the concentration of a toner decreases, the concentration of the toner image developed by the liquid development agent D will become low. When the concentration of the toner in Developer D changes from this, it turns out that the amount of development by the developer D with which development is presented changes.
[0038] Moreover, if the concentration of the electric charge control agent in the liquid development agent D decreases so that drawing 3 may show, the amount of development will increase. That is, if the concentration of an electric charge control agent decreases, the concentration of the toner image developed by the liquid development agent D will become high. When the concentration of the electric charge control agent in Developer D changes from this, it turns out that the amount of development by the developer D with which development is presented changes.
[0039] Since a poor image, such as the so-called concentration variation, will be invited, it is necessary to detect the toner in Developer D, and the concentration of an electric charge control agent, and to control by change of this amount of development to maintain such concentration at proper concentration. Here, the transparency mold photosensor 49 performs concentration detection of the toner in Developer D, and the reflective mold photosensor 6 performs concentration detection of an electric charge control agent. Moreover, a control section CONT controls the concentrated liquid feeder 46, the electric charge control agent feeder 47, and the carrier liquid feeder 48 to maintain such concentration at proper concentration.
[0040] Next, it explains, referring to drawing 4 etc. about detection of the toner in a developer, and the concentration of an electric charge control agent, and control. The control section CONT is connected to the reflective mold photosensor 6, the concentrated liquid feeder 46, the electric charge control agent feeder 47, the carrier liquid feeder 48, the transparency mold photosensor 49, and the pump 44 as stated above. Moreover, it connects with the main control section which controls actuation of the whole image formation equipment, and a control section CONT controls the toner in a liquid development agent, the concentration of an electric charge control agent, etc. based on the indication signal from the main control section.

[0041] In addition, the reference value of two kinds of toner concentration is beforehand set to a control section CONT for concentration control of the toner in a liquid development agent, and an electric charge control agent. One toner concentration reference value is a reflection density reference value equivalent to the toner concentration by which electric charge control agent concentration and toner concentration form the toner image for optical reflection density detection on a photo conductor 1 using a proper liquid development agent, and are detected by said reflective mold photosensor 6 from this toner image for concentration detection. Another toner concentration reference value is a transmission density reference value equivalent to the toner concentration detected by the transparency mold photosensor 49 from a liquid development agent with proper toner concentration.

[0042] When controlling the concentration of the electric charge control agent in the liquid development agent D, the toner image for optical reflection density detection is formed on the photo conductor drum 1. This toner image for concentration detection is independently formed on a photo conductor 1 periodically with the usual image formation. When the concentration of this toner image for concentration detection is high, the quantity of light which is reflected from this toner image by luminescence from light-emitting part 6a of a sensor 6, and is received by light sensing portion 6b is small, and the detection value (output voltage) of a sensor 6 becomes low, and when the concentration of the toner image for concentration detection is low on the contrary, the detection value (output voltage) of a sensor 6 becomes high. The detection value (output voltage) is sent to a control section CONT.

[0043] A control section CONT compares a predetermined reflection density reference value (predetermined reference voltage) with the detection value (output voltage) of a sensor 6. If said toner image for concentration detection judges that concentration is higher than the toner image of proper concentration and puts in another way, it passes low and it judges that the amount of development has increased (refer to drawing 3), and a signal will be supplied to the electric charge control agent feeder 47, and the concentration of the electric-charge control agent in Developer D will make an electric-charge control agent supply to the liquid development agent D from delivery and this equipment 47, when a detection value (output voltage) is lower than a predetermined reference value (predetermined reference voltage). Thereby, the concentration of the electric charge control agent in Developer D rises, and the amount of development by the developer D with which development is presented decreases. Moreover, when the detection value (output voltage) of a sensor 6 is higher than a predetermined reference value (predetermined reference voltage), it judges that its concentration of the electric charge control agent in Developer D will be too high, and its amount of development will have decreased if said toner image for concentration detection judges that concentration is lower than the toner image of proper concentration and it puts in another way (R> drawing 3 3 reference), and carrier liquid is made to supply to the liquid development agent D from the carrier liquid feeder 48. Thereby, the concentration of the electric charge control agent in Developer D becomes low. By these actuation, the electric charge control agent in Developer D is maintained to proper concentration.

[0044] In addition, although control here was performed based on the toner image for concentration detection which used the black toner When this toner image for concentration detection is formed with a color toner like a yellow toner and there are many amounts of toners of this toner image, since the specular reflection property of a photo conductor is strong, That is, when toner concentration is high, contribution of scattered-light reinforcement is large, and the amount of reflected lights increases, as a result the detection value (output voltage) of a sensor 6 becomes high. Therefore, what is necessary is just to make control of electric charge control agent concentration based on the detection value (output voltage) of the sensor 6 to a predetermined reference value (predetermined reference voltage) into the above and reverse, when adopting such a toner.

[0045] When controlling the concentration of the toner in the liquid development agent D, the light transmission nature of the liquid development agent D is detected. This detection is periodically performed by the transparency mold photosensor 49. The toner concentration in the liquid development agent D and the detection value (output voltage) of the transparency mold photosensor 49 have the relation of an inverse proportion. That is, when the concentration of the toner in Developer D is high, the quantity of light which is emitted from light-emitting part 49a of a sensor 49, and is received by light sensing portion 49b is small, and the detection value (output voltage) of a sensor 49 becomes low, and when toner concentration is low on the contrary, the detection value (output voltage) of a sensor 49 becomes high. The detection value (output voltage) is sent to a control section CONT.

[0046] A control section CONT compares said predetermined transmission density reference value (predetermined reference voltage) and detection value (output voltage) of a sensor 49. When a detection value

(output voltage) is higher than a predetermined reference value (predetermined reference voltage), it judges that the concentration of the toner in the liquid development agent D is lower than proper concentration, and a signal is supplied to the concentrated liquid feeder 46, and delivery and a toner are made to supply to the liquid development agent D. Thereby, the toner concentration in Developer D rises. Moreover, when a detection value (output voltage) is lower than a predetermined reference value (predetermined reference voltage), it judges that the concentration of the toner in the liquid development agent D is higher than proper concentration, and carrier liquid is made to supply from the carrier liquid feeder 48. Thereby, the concentration of the toner in Developer D falls. The toner concentration in Developer D is maintained proper by these.

[0047] Moreover, a control section CONT makes a pump 44 circulate a signal through the liquid development agent D between the delivery developer feeder 400 and a developer 4, while liquid development equipment 4 is developing negatives. According to the image formation equipment explained above, the concentration of the toner image for optical reflection density detection formed on a photo conductor 1 is detected by the reflective mold photosensor 6, and a control section CONT is controlled to maintain the concentration of the electric charge control agent in the liquid development agent D at proper concentration based on the toner image concentration by this detection. Therefore, without needing the special means and special maintenance for removing toner adhesion in this electrode like [in the case of asking for electric charge control agent concentration by preparing an electrode into a liquid development agent like before and measuring conductivity], the concentration of an electric charge control agent can be detected correctly, the concentration of an electric charge control agent can be maintained proper by that cause, and a good image can be obtained stably.

[0048] Drawing 6 is drawing showing the outline configuration of the image formation equipment which is other operation gestalten of this invention. The image formation equipment shown in drawing 6 forms the toner image for optical reflection density detection formed on the photo conductor 1 in the image formation equipment shown in drawing 1 on the recording paper S, and forms the reflective mold photosensor 6 in the location which can detect the concentration of this toner image. Other points are the same as that of the equipment of drawing 1 R> 1, and have given the same reference mark to the same components.

[0049] The migration path of the recording paper S was made to face the reflective mold photosensor 6 in the left-hand side of guide plate 12a with this image formation equipment in the direction of surface migration of the recording paper S by the downstream from the imprint section P. This reflective mold photosensor 6 is also connected to the control section CONT. Light-emitting part 6a and light sensing portion 6b of the reflective mold photosensor 6 are turned to guide plate 12a, respectively, and can detect the concentration of the toner image for optical reflection density detection formed in the recording paper S which passes guide plate 12a. Moreover, the control section CONT is changed into the detection timing of the toner image concentration formed on the recording paper S in the concentration detection timing control by the reflective mold photosensor 6 here.

[0050] Also in this image formation equipment, in the image formation equipment of drawing 1 , similarly, the concentration of the toner image for optical reflection density detection formed on the recording paper S by the reflective mold photosensor 6 is detected, and a control section CONT is controlled to maintain the concentration of the electric charge control agent in the liquid development agent D at proper concentration based on the toner image concentration by this detection. Therefore, without needing the special means and special maintenance for removing toner adhesion in this electrode like [in the case of preparing an electrode into a liquid development agent like before for electric charge control agent concentration measurement, and measuring conductivity], the concentration of an electric charge control agent can be detected correctly, the concentration of an electric charge control agent can be maintained proper by that cause, and a good image can be obtained stably.

[0051] Moreover, also in this image formation equipment, once an imprint method imprints the primary toner image on middle imprint objects, such as an imprint drum and an imprint belt, it may use the so-called middle imprint method imprinted to record material. In this case, what is necessary is just to install the reflective mold photosensor 6 so that the concentration of the toner image for optical reflection density detection formed on a middle imprint object may be detected.

[0052]

[Effect of the Invention] According to this invention, it is image formation equipment developed using the liquid development agent containing the electric charge control agent for giving a charge for the electrostatic latent image formed on electrostatic latent-image support into carrier liquid at a toner particle and this toner particle. Without needing the special means and special maintenance for removing toner adhesion in an electrode like [in

the case of preparing an electrode into a liquid development agent like before, and measuring conductivity] in detecting the concentration of an electric charge control agent The concentration of an electric charge control agent can be detected correctly, and the image formation equipment which can maintain the concentration of an electric charge control agent proper by that cause, and can obtain a good image stably can be offered.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is drawing showing the outline configuration of the image formation equipment which is 1 operation gestalt of this invention.
[Drawing 2] It is drawing showing the relation between the concentration of the toner in a liquid development agent, and the amount of development by this liquid development agent.
[Drawing 3] It is drawing showing the relation between the concentration of the electric charge control agent in a liquid development agent, and the amount of development by this liquid development agent.
[Drawing 4] It is the block diagram showing the outline of the control circuit for the electric charge control agent concentration control in the image formation equipment shown in drawing 1 etc.
[Drawing 5] It is drawing showing in more detail the structure of a developer feeder prepared in the image formation equipment shown in drawing 1 .
[Drawing 6] It is drawing showing the outline configuration of the image formation equipment which is other operation gestalten of this invention.
[Description of Notations]
1 Photo Conductor (Electrostatic Latent-Image Support)
2 Electrification Equipment
3 Aligner
4 Liquid Development Equipment
41 Developing Roller
42 Developer Tub
D Liquid development agent
5 Squeeze Roller
6 Reflective Mold Photosensor (Optical Reflection Density Detection Means)
6a The light-emitting part of a reflective mold photosensor
6b The light sensing portion of a reflective mold photosensor
7 Imprint Roller
8 Cleaner
9 Eraser Lamp
P Imprint section
10a, 10b, 12a, 12b Guide plate
11 Timing Roller Pair
13 Fixing Assembly
PW1, PW2, PW3 Power source
L Laser beam
S Recording paper
100 Developer Feeder
113a The tube for developer supply
113b The tube for developer circulation
114 Pump
115 Developer Tank
116 Concentrated Liquid Feeder
116a Concentrated liquid tank

46b Concentrated liquid feed zone (pump)
46c Concentrated liquid nozzle
47 Electric Charge Control Agent Feeder
47a Electric charge control agent tank
47b Electric charge control agent feed zone (pump)
47c Electric charge control agent nozzle
48 Carrier Liquid Feeder
48a Carrier liquid tank
48b Carrier liquid feed zone (pump)
48c Carrier liquid nozzle
49 Transparency Mold Photosensor
49a The light-emitting part of a transparency mold photosensor
49b The light sensing portion of a transparency mold photosensor
49c Sensor supporter material
CONT Control section

[Translation done.]

(19)日本国特許庁（ＪＰ）　(12) 公開特許公報（Ａ）　(11)特許出願公開番号

特開平11－65295

(43)公開日　平成11年(1999) 3月5日

(51)Int.Cl.[6]	識別記号	ＦＩ	
Ｇ０３Ｇ　15/11		Ｇ０３Ｇ　15/10	１１５

審査請求　未請求　請求項の数３　ＯＬ　（全９頁）

(21)出願番号　特願平9－220295

(22)出願日　平成９年(1997) ８月15日

(71)出願人　000006079
ミノルタ株式会社
大阪府大阪市中央区安土町二丁目３番13号
大阪国際ビル

(72)発明者　金沢　正晴
大阪市中央区安土町二丁目３番13号　大阪国際ビル　ミノルタ株式会社内

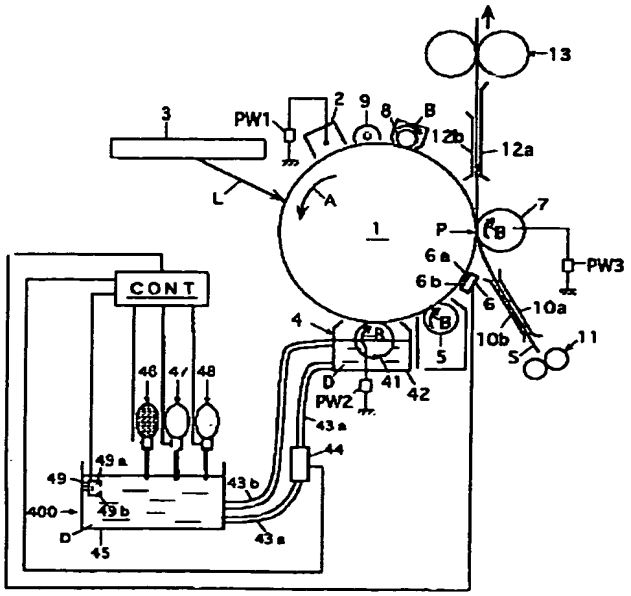
(74)代理人　弁理士　谷川　昌夫

(54)【発明の名称】　画像形成装置

(57)【要約】

【課題】　荷電制御剤の濃度を検出するにあたり、従来のように液体現像剤中に電極を設けて導電率を測定する場合のように該電極へのトナー付着を取り除くための特別な手段やメンテナンスを必要とすることなく、荷電制御剤の濃度を正確に検出でき、それにより荷電制御剤の濃度を適正に維持して良好な画像を安定的に得ることができる画像形成装置を提供する。

【解決手段】　感光体１（静電潜像担持体）上に形成される静電潜像をキャリア液中にトナー粒子及び該トナー粒子に電荷を付与するための荷電制御剤を含む液体現像剤Ｄを用いて現像し、得られた可視像を記録紙Ｓに転写する画像形成装置であり、感光体１又は記録紙Ｓに形成される光学的反射濃度検出用のトナー像の濃度を検出する反射型光センサ６（光学的反射濃度検出手段）と、センサ６により検出されるトナー像濃度に基づいて現像剤Ｄ中の荷電制御剤の濃度を適正濃度に保つ荷電制御剤濃度制御手段（荷電制御剤供給装置４７、キャリア液供給装置４８及び制御部ＣＯＮＴ）とを備えている画像形成装置。



【特許請求の範囲】
【請求項１】静電潜像担持体上に形成される静電潜像をキャリア液中にトナー粒子及び該トナー粒子に電荷を付与するための荷電制御剤を含む液体現像剤を用いて現像し、得られた可視像を被転写体に転写する画像形成装置であって、
いずれかの部材に形成される光学的反射濃度検出用のトナー像に光を照射して、該トナー像から反射する反射光に基づいて該トナー像の濃度を検出する光学的反射濃度検出手段と、
前記光学的反射濃度検出手段により検出される前記トナー像濃度に基づいて前記液体現像剤中の荷電制御剤の濃度を適正濃度に保つように制御する荷電制御剤濃度制御手段とを備えていることを特徴とする画像形成装置。
【請求項２】前記光学的反射濃度検出手段は、発光手段及び受光手段を含み、該発光手段及び受光手段は、前記静電潜像担持体上に形成される前記光学的反射濃度検出用トナー像の濃度を検出するように前記静電潜像担持体に臨んでいる請求項１記載の画像形成装置。
【請求項３】前記光学的反射濃度検出手段は、発光手段及び受光手段を含み、該発光手段及び受光手段は、前記被転写体上に形成される前記光学的反射濃度検出用トナー像の濃度を検出するように前記被転写体の移動通路に臨んでおり、該被転写体移動方向において転写領域より下流側に設けられている請求項１記載の画像形成装置。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】本発明は静電潜像を液体現像剤を用いて現像し、被転写体に転写する複写機、プリンタ等の画像形成装置に関する。
【０００２】
【従来の技術】複写機、プリンタ等の画像形成装置において、液体現像剤を用いて画像形成する場合、一般的には、感光体等の静電潜像担持体表面を帯電させ、その帯電域に画像情報に基づいて画像露光して静電潜像を形成し、その潜像を液体現像剤を用いて現像して可視トナー像とし、このトナー像を直接紙等の記録材に転写するか、又は一旦中間転写部材に１次転写し、さらに記録材に２次転写し、定着させる。
【０００３】液体現像剤は、一般的に、トナー、荷電制御剤及びキャリア液を含んでいる。通常、トナーは着色された樹脂からなり、荷電制御剤は該トナーに電荷を付与する。トナー及び荷電制御剤はキャリア液に分散され、これらは、静電潜像を良好なトナー画像に現像できるようにそれぞれ適正な濃度に調整される。この液体現像剤は液体現像装置から静電潜像担持体上に形成された静電潜像に供給され、静電潜像は荷電制御剤によって電荷を付与されたトナーを静電吸着して可視像となる。これによって、トナー及び荷電制御剤が消費され、現像剤中のトナー及び荷電制御剤の濃度が低下する。これらの濃度が低下（変化）することによって、現像量、すなわち現像に供されるトナー量、換言すれば現像により得られるトナー像の濃度が変化する。この現像量の変化により、現像された画像間に濃度のバラツキが発生する等して画像不良を招くことになる。このような濃度バラツキのない良好な画像を得るには、静電潜像が顕像化されるとき、現像に供される現像剤による現像量を適正値に保つ必要がある。そのためには、現像剤中のトナー及び荷電制御剤の濃度を適正濃度に保つ必要がある。
【０００４】現像によって消費されるトナー及び荷電制御剤の量は、現像する画像の種類（文字画像、写真画像など）によって異なるので、現像毎など定期的にトナー及び荷電制御剤の濃度を検出することで、これらの濃度を適正濃度に保つように制御することが望ましい。ここで従来の荷電制御剤の濃度を検出する方法についてみると、液体現像剤の導電率と荷電制御剤の濃度との間の一定の関係を利用する方法がある。この検出方法は、液体現像剤中に２つの電極を設けて、それらの電極に電圧を印加し、両電極間の現像剤に流れる電流から現像剤の導電率を測定し、その測定値に基づいて現像剤中の荷電制御剤の濃度を検出するものである。
【０００５】
【発明が解決しようとする課題】しかしながら、このような方法では、電荷を帯びた現像剤中のトナーは、該電荷とは逆極性の電圧が印加された電極の方に引き寄せられ、該電極表面に付着するので、該電極に流れる電流の導通性を妨げる。このため、両電極間に流れる電流が変化し、荷電制御剤の濃度を正確に検出できないという問題がある。それを解決するには、例えば、トナーの付着する電極についてそれを清掃する電極清掃機構を設けたり、トナーの付着する電極をサービスマンなどが定期的に清掃する必要がある。しかし、電極清掃機構を設けると、それだけ画像形成装置の複雑化やコストアップ等を招くことになる。また、定期的に清掃メンテナンスを行うとなると、サービスマンなどのメンテナンス作業負担の増加を招くことになる。
【０００６】そこで本発明は、静電潜像担持体上に形成される静電潜像をキャリア液中にトナー粒子及び該トナー粒子に電荷を付与するための荷電制御剤を含む液体現像剤を用いて現像する画像形成装置であって、荷電制御剤の濃度を検出するにあたり従来のように液体現像剤中に電極を設けて導電率を測定する場合のように電極へのトナー付着を取り除くための特別な手段やメンテナンスを必要とすることなく、荷電制御剤の濃度を正確に検出でき、それにより荷電制御剤の濃度を適正に維持して良好な画像を安定的に得ることができる画像形成装置を提供することを課題とする。
【０００７】
【課題を解決するための手段】前記課題を解決するため本発明の画像形成装置は、静電潜像担持体上に形成され

る静電潜像をキャリア液中にトナー粒子及び該トナー粒子に電荷を付与するための荷電制御剤を含む液体現像剤を用いて現像し、得られた可視像を被転写体に転写する画像形成装置であって、いずれかの部材に形成される光学的反射濃度検出用のトナー像に光を照射して、該トナー像から反射する反射光に基づいて該トナー像の濃度を検出する光学的反射濃度検出手段と、前記光学的反射濃度検出手段により検出される前記トナー像濃度に基づいて前記液体現像剤中の荷電制御剤の濃度を適正濃度に保つように制御する荷電制御剤濃度制御手段とを備えていることを特徴としている。

【０００８】この画像形成装置においては、前記光学的反射濃度検出手段によって前記光学的反射濃度検出用トナー像の濃度を検出する。前記荷電制御剤濃度制御手段は、該検出によるトナー像濃度に基づいて前記液体現像剤中の荷電制御剤の濃度を適正濃度に保つように制御する。従って、荷電制御剤濃度検出のために液体現像剤中に電極を設けて導電率を測定する場合のように該電極へのトナー付着を取り除くための特別な手段やメンテナンスを必要とすることなく、荷電制御剤の濃度を正確に検出でき、それにより荷電制御剤の濃度を適正に維持して良好な画像を安定的に得ることができる。

【０００９】前記いずれかの部材に形成される濃度検出用トナー像の濃度を検出する前記光学的反射濃度検出手段は、例えば、前記静電潜像担持体上に形成される該トナー像の濃度を検出するものや、前記被転写体上に形成される該トナー像の濃度を検出するものを挙げることができる。さらに言えば、前記光学的反射濃度検出手段は、例えば発光手段及び受光手段を含み、該発光手段及び受光手段が、前記静電潜像担持体上に形成される前記光学的反射濃度検出用トナー像の濃度、さらに好ましくは前記静電潜像担持体上に形成される前記光学的反射濃度検出用トナー像であってスクイーズ装置を通過して余分なキャリア液を除去されたトナー像の濃度を検出するように前記静電潜像担持体に臨んでいるものである。この場合、発光手段及び受光手段は、例えば該像担持体表面移動方向において静電潜像現像領域より下流側且つ転写領域より上流側に設けられる。また、発光手段及び受光手段を含み、該発光手段及び受光手段が、前記被転写体上に形成される前記光学的反射濃度検出用トナー像の濃度を検出するように、前記被転写体の移動通路に臨んでおり、該被転写体移動方向において転写領域より下流側に設けられているものを例示できる。

【００１０】なお、前記被転写体とは、例えば、紙等の記録材や中間転写ベルト、中間転写ドラム等の中間転写体などを挙げることができる。前記光学的反射濃度検出手段による前記濃度検出用トナー像の濃度の検出については、例えば、予め適正な濃度の基準トナー像を静電潜像担持体や被転写体上に形成してそのトナー像の濃度を検出し、これを確定基準濃度とし、一方濃度検出用トナー像を定期的に静電潜像担持体や被転写体上に形成し、そのトナー像の濃度と前記基準トナー像の確定基準濃度を比較することで行えばよい。この場合、形成された濃度検出用トナー像から検出されるトナー像濃度は基準トナー像の確定基準濃度に一致するとはかぎらず、一致しないときは、液体現像剤中の荷電制御剤の濃度を制御すればよいのである。

【００１１】前記荷電制御剤濃度制御手段については、例えば、現像に供される液体現像剤に荷電制御剤を補給する荷電制御剤補給手段と、前記光学的反射濃度検出手段により検出される前記濃度検出用トナー像の濃度に基づいて該液体現像剤中の荷電制御剤濃度を適正濃度に維持するように該荷電制御剤補給手段をコントロールする制御手段とを含むものを挙げることができる。

【００１２】また、荷電制御剤濃度制御手段は、現像に供される液体現像剤に荷電制御剤を補給する荷電制御剤補給手段と、該液体現像剤にキャリア液を補給するキャリア液補給手段と、前記光学的反射濃度検出手段により検出される前記濃度検出用トナー像の濃度に基づいて液体現像中の荷電制御剤濃度を適正濃度に維持するように該荷電制御剤補給手段及びキャリア液補給手段をコントロールする制御手段とを含むものでもよい。

【００１３】これらのうちいずれの荷電制御剤濃度制御手段においても、液体現像剤中の荷電制御剤濃度が低すぎるときは、荷電制御剤補給手段から荷電制御剤が補給される。後者の荷電制御剤濃度制御手段によると、液体現像剤中の荷電制御剤濃度が高すぎるときは、キャリア液補給手段からキャリア液が補給される。なお、この画像形成装置は、液体現像剤中のトナー濃度を検出する手段及び液体現像剤中のトナー濃度を制御する手段を備えることができることは勿論である。

【００１４】かかるトナー濃度検出手段として、前記液体現像剤に光を照射して該液体現像剤を透過する透過光から該液体現像剤中のトナー濃度を検出する光学的透過濃度検出手段を例示できる。この場合、トナー濃度制御手段として、該光学的透過濃度検出手段により検出されるトナー濃度に基づいて前記液体現像剤中のトナーの濃度を適正濃度に保つように制御するトナー濃度制御手段を挙げることができる。

【００１５】前記光学的透過濃度検出手段による前記液体現像剤中のトナー濃度の検出については、例えば、予め適正なトナー濃度の基準液体現像剤を準備し、該基準液体現像剤から検出されるトナー濃度を確定基準濃度としておき、一方液体現像剤中のトナーの濃度を定期的に検出し、そのトナー濃度と前記確定基準濃度を比較することで行えばよい。この場合、液体現像剤から検出されるトナーの濃度は基準トナー濃度に一致するとはかぎらず、一致しないときは、液体現像剤中のトナーの濃度を制御すればよい。

【００１６】トナー濃度制御手段については、例えば、

現像に供される液体現像剤にトナーを補給するトナー補給手段（例えば濃縮トナー含有液であるコンク液の補給手段）と、前記光学的透過濃度検出手段により検出される液体現像剤中トナー濃度に基づいて該液体現像中のトナー濃度を所定の適正濃度に維持するように該トナー補給手段をコントロールする制御手段とを含むものを挙げることができる。

【００１７】また、トナー濃度制御手段は、現像に供される液体現像剤にトナーを補給するトナー補給手段（例えば濃縮トナー含有液であるコンク液の補給手段）と、該液体現像剤にキャリア液を補給するキャリア液補給手段と、前記光学的透過濃度検出手段により検出される液体現像剤中トナー濃度に基づいて液体現像中のトナー濃度を適正濃度に維持するように該トナー補給手段及びキャリア液補給手段をコントロールする制御手段とを含むものでもよい。

【００１８】これらのうちいずれのトナー濃度制御手段においても、液体現像剤中のトナー濃度が低すぎるときは、トナー補給手段からトナーが補給される。後者のトナー濃度制御手段によると、液体現像剤中のトナー濃度が高すぎるときは、キャリア液補給手段からキャリア液が補給される。

【００１９】

【発明の実施の形態】以下、本発明の実施の形態を図面を参照して説明する。図１は本発明の１実施形態である画像形成装置の概略構成図である。図１に示す画像形成装置は電子写真方式の画像形成装置であり、中央にドラム形状の感光体１（静電潜像担持体の１例）を備えている。感光体１の周囲には、帯電装置２、露光装置３、液体現像装置４、スクイーズローラ５、反射型光センサ６（光学的反射濃度検出手段の１例の１部）、転写ローラ７、クリーナ８及びイレーサランプ９がこの順に配置されている。

【００２０】感光体１は、図中反時計方向Ａに回転駆動される。ここでの感光体１は、ドラム状の感光体ドラムであるが、ベルト形状の感光体ベルトなどでもよい。転写ローラ７は、感光体１に臨み、図中、転写部Ｐを形成している。転写部Ｐの図中下方にはガイド板１０ａ、１０ｂ及びタイミングローラ対１１が設けられ、さらに図示を省略した給紙部が設けられている。また、上方にはガイド板１２ａ、１２ｂ、定着器１３が順次設けられ、さらに図示を省略した排出ローラ対及び排紙トレイが設けられている。

【００２１】帯電装置２は電源ＰＷ１から高電圧を印加でき、これにより感光体１を帯電させることができる。露光装置３は図示を省略した画像読み取り装置等から送られてくる画像情報に基づきレーザ光Ｌを感光体１に照射でき、これにより感光体１上に静電潜像を形成できる。

【００２２】液体現像装置４は、現像ローラ４１と現像剤槽４２を含んでおり、液体現像剤Ｄを収容する。現像ローラ４１は図中時計方向Ｂに回転駆動され、電源ＰＷ２から現像バイアス電圧を印加できる。これにより感光体１上の静電潜像を現像できる。スクイーズローラ５は感光体１に接触配置され、感光体１の回転に伴い図中Ｂ方向に回転駆動される。これにより感光体１上に付着したキャリア液を所定量まで除去できる。なお、図中、スクイーズローラ５は液体現像装置４とは別個に設けているが、液体現像装置４と同様な位置に一体的に組み合わせて設けてもよい。

【００２３】反射型光センサ６は発光部６ａ及び受光部６ｂを含み、発光部６ａから感光体１上に形成される後述する光学的反射濃度検出用トナー像に光を照射して、該トナー像から反射する反射光を受光部６ｂで受ける。これにより感光体１上の該トナー像濃度を検出できる。転写ローラ７は図中Ｂ方向に回転駆動され、電源ＰＷ３から転写用電圧を印加でき、これにより感光体１上のトナー像を後述する記録紙Ｓに転写できる。

【００２４】クリーナ８はローラタイプのもので、感光体１に接触配置され、感光体１の回転に伴い図中Ｂ方向に回転駆動される。これにより感光体１上に付着した、記録紙Ｓに転写されずに残った転写残トナーを除去できる。イレーサランプ９は感光体１に光照射でき、これにより感光体１上の電荷を光除電できる。

【００２５】また、この画像形成装置には現像剤供給装置４００が設けられている。この供給装置４００は現像剤供給用チューブ４３ａと現像剤循環用チューブ４３ｂを介して液体現像装置４の現像剤槽４２に接続されている。供給用チューブ４３ａの途中にはポンプ４４が設けられている。液体現像剤Ｄは、ポンプ４４によって供給装置４００からチューブ４３ａを通って現像剤槽４２に供給される。さらに現像ローラ４１にて感光体１上の静電潜像の現像に供されたあと、チューブ４３ｂを通って供給装置４００に戻る。これにより、現像剤Ｄは供給装置４００と現像装置４間を循環する。

【００２６】現像剤供給装置４００は現像剤タンク４５、コンク液（濃縮トナー含有液）供給装置４６、荷電制御剤供給（補給）装置４７、キャリア液供給（補給）装置４８及び透過型光センサ４９を備えている。現像剤タンク４５は液体現像剤Ｄを収容する。コンク液供給装置４６、荷電制御剤供給装置４７、キャリア液供給装置４８はそれぞれトナー、荷電制御剤、キャリア液を現像剤タンク４５の現像剤Ｄに供給できる。センサ４９は発光部４９ａ及び受光部４９ｂを含み、発光部４９ａから現像剤Ｄに光を照射して、現像剤Ｄを透過する透過光を受光部４９ｂで受け、現像剤Ｄの光透過性を検出する。これにより現像剤Ｄ中のトナーの濃度を検出できる。

【００２７】また、この画像形成装置は制御部ＣＯＮＴを備えている。該制御部はコンピュータを中心に構成されており、荷電制御剤濃度制御手段の１例の１部、トナ

ー濃度制御手段の１例の一部等を含んでいる。制御部ＣＯＮＴは図１及び図４に示すように、反射型光センサ６、コンク液供給装置４６、荷電制御剤供給装置４７、キャリア液供給装置４８、透過型光センサ４９及びポンプ４４に接続されている。制御部ＣＯＮＴは画像形成装置全体の動作を制御する主制御部（図４参照）からの指示信号に基づいて液体現像剤中のトナー及び荷電制御剤の濃度などを制御できる。なお、制御部ＣＯＮＴは前記主制御部とは別個に設けたが該主制御部内に含めて制御するようにしてもよい。

【００２８】図５は前記現像剤供給装置４００のより詳細な構造説明図である。現像剤供給装置４００は、既述のとおり現像剤タンク４５、コンク液供給装置４６、荷電制御剤供給装置４７、キャリア液供給装置４８及び透過型光センサ４９を備えている。現像剤タンク４５は液体現像剤Ｄを収容する。コンク液供給装置４６はコンク液タンク４６ａ、コンク液供給部４６ｂ、コンク液ノズル４６ｃから構成されている。タンク４６ａはトナーを濃縮したトナー濃縮液を収容し、供給部４６ｂはポンプであり、制御部ＣＯＮＴからの指示信号によりタンク４６ａのトナー濃縮液をノズル４６ｃからタンク４５の現像剤Ｄに供給できる。

【００２９】荷電制御剤供給装置４７は荷電制御剤タンク４７ａ、荷電制御剤供給部４７ｂ、荷電制御剤ノズル４７ｃから構成されている。タンク４７ａは荷電制御剤を濃縮した荷電制御剤濃縮液を収容し、供給部４７ｂはポンプであり、制御部ＣＯＮＴからの指示信号によりタンク４７ａの荷電制御剤を濃縮した荷電制御剤濃縮液をノズル４７ｃからタンク４５の現像剤Ｄに供給できる。

【００３０】キャリア液供給装置４８はキャリア液タンク４８ａ、キャリア液供給部４８ｂ、キャリア液ノズル４８ｃから構成されている。タンク４８ａはキャリア液を収容し、供給部４８ｂはポンプであり、制御部ＣＯＮＴからの指示信号によりタンク４８ａのキャリア液をノズル４８ｃからタンク４５の現像剤Ｄに供給できる。透過型光センサ４９は、発光部４９ａ及び受光部４９ｂを含み、現像剤タンク４５内に設けられている。センサ４９はセンサ支持部材４９ｃに支持されてセンサ全体が液体現像剤Ｄに浸けられる。発光部４９ａから光を照射し、現像剤Ｄの透過光を受光部４９ｂで受光して、現像剤Ｄ中のトナー濃度を検出し、その検出値（出力電圧）を制御部ＣＯＮＴへ送る。

【００３１】以下、図１に示す画像形成装置の画像形成動作を説明し、そのあと反射型光センサ６、透過型光センサ４９、制御部ＣＯＮＴ及び現像剤供給装置４００などによる液体現像剤中のトナー及び荷電制御剤の濃度の検出、制御について詳しく説明する。この画像形成装置は、感光体１が回転駆動され、帯電装置２によって一様に帯電される。

【００３２】露光装置３から照射されたレーザ光しが該帯電域を露光し、静電潜像を形成する。この静電潜像は感光体１の回転とともに液体現像装置４に移行する。液体現像装置４では、現像ローラ４１の一部が液体現像剤Ｄに浸かっており、現像ローラ４１の回転に伴って現像剤Ｄを汲み上げ、感光体１に形成される静電潜像に供してこれを現像バイアス電圧印加のもとに現像し、可視トナー像とする。

【００３３】可視トナー像はスクイーズローラ５によって余分なキャリア液が取り除かれ、転写部Ｐに移行する。なお、現像剤供給装置４００、反射型光センサ６などの動作については後ほど説明する。転写部Ｐに移行したトナー像は記録紙Ｓに転写される。記録紙Ｓは図示を省略した給紙ローラによって同じく図示を省略した給紙トレイから送り出され、タイミングローラ対１１に送られる。タイミングローラ対１１は、感光体１上のトナー像と同期をとって、記録紙Ｓを送り出す。記録紙Ｓは、ガイド板１０ａ、１０ｂに支持されて転写部Ｐに移行する。

【００３４】転写部Ｐでは、転写ローラ７が記録紙Ｓを裏面から感光体１方向へ押圧する。感光体１上のトナー像は記録紙Ｓに接触し、電源ＰＷ３からの電圧印加によってローラ７側に引き寄せられて、記録紙Ｓに転写される。記録紙Ｓはトナー像転写後、ガイド板１２ａ、１２ｂに支持されて定着器１３に運ばれ、ここでトナー像が記録紙Ｓに定着される。そのあと図示を省略した排紙ローラ対にて排紙トレイへ排出される。

【００３５】なお、ここでの転写方式は、感光体１上のトナー像を直接記録紙Ｓに転写するものであるが、トナー像を一旦転写ドラムや転写ベルト等の中間転写体に１次転写した後、記録材に転写する、いわゆる中間転写方式を採用してもよい。また、ここではトナー像の記録紙Ｓへの転写を静電的に行うものを採用したが、転写ローラ７に代えて、適当な圧力の下に熱的に転写する熱転写ローラ等を採用してもよい。

【００３６】感光体１には記録紙Ｓに転写されずに残ったトナーが保持されているが、クリーナ８がこの転写残トナーを除去する。そのあとイレーサランプ９から感光体１に光が照射され、感光体１上の電荷は光除電される。そして、感光体１は次の画像形成に備えられる。次に、液体現像剤中のトナー又は荷電制御剤の濃度の変化に対する液体現像剤による静電潜像の現像量の変化について、図２及び図３を参照しながら説明する。

【００３７】図２は液体現像剤中のトナーの濃度と現像量の関係の１例を示す図であり、図３は液体現像剤中の荷電制御剤の濃度と現像量の関係の１例を示す図である。図２から分かるようにように、液体現像剤Ｄ中のトナーの濃度が減少すると現像量も減少する。すなわち、トナーの濃度が減少すると液体現像剤Ｄによって現像されたトナー像の濃度が低くなる。このことから、現像剤Ｄ中のトナーの濃度が変化すると、現像に供される現像

剤Ｄによる現像量が変化することがわかる。

【００３８】また、図３から分かるように、液体現像剤Ｄ中の荷電制御剤の濃度が減少すると現像量は増加する。すなわち、荷電制御剤の濃度が減少すると液体現像剤Ｄによって現像されたトナー像の濃度が高くなる。このことから、現像剤Ｄ中の荷電制御剤の濃度が変化すると、現像に供される現像剤Ｄによる現像量が変化することがわかる。

【００３９】かかる現像量の変化により、いわゆる濃度バラツキなどの画像不良を招くことになるから、現像剤Ｄ中のトナー及び荷電制御剤の濃度を検出し、これらの濃度を適正濃度に保つように制御する必要がある。ここでは現像剤Ｄ中のトナーの濃度検出は透過型光センサ４９が行い、荷電制御剤の濃度検出は反射型光センサ６が行う。また、制御部ＣＯＮＴはこれらの濃度を適正濃度に保つようにコンク液供給装置４６、荷電制御剤供給装置４７、キャリア液供給装置４８を制御する。

【００４０】次に、現像剤中のトナー及び荷電制御剤の濃度の検出、制御について図４等を参照しながら説明する。既述のとおり制御部ＣＯＮＴは、反射型光センサ６、コンク液供給装置４６、荷電制御剤供給装置４７、キャリア液供給装置４８、透過型光センサ４９及びポンプ４４に接続されている。また制御部ＣＯＮＴは画像形成装置全体の動作を制御する主制御部に接続され、主制御部からの指示信号に基づいて液体現像剤中のトナー及び荷電制御剤の濃度などを制御する。

【００４１】なお制御部ＣＯＮＴには、液体現像剤中のトナー及び荷電制御剤の濃度制御のために２種類のトナー濃度の基準値が予め設定される。一つのトナー濃度基準値は、荷電制御剤濃度及びトナー濃度が適正である液体現像剤を用いて感光体１上に光学的反射濃度検出用トナー像を形成し、この濃度検出用トナー像から前記反射型光センサ６により検出されるトナー濃度に相当する反射濃度基準値である。もう一つのトナー濃度基準値は、トナー濃度が適正である液体現像剤から透過型光センサ４９により検出されるトナー濃度に相当する透過濃度基準値である。

【００４２】液体現像剤Ｄ中の荷電制御剤の濃度を制御する場合、光学的反射濃度検出用トナー像が感光体ドラム１上に形成される。この濃度検出用トナー像は通常の画像形成とは別に定期的に感光体１上に形成される。この濃度検出用トナー像の濃度が高いとき、センサ６の発光部６ａからの発光により該トナー像から反射されて受光部６ｂで受光される光量は小さく、センサ６の検出値（出力電圧）は低くなり、反対に濃度検出用トナー像の濃度が低いときセンサ６の検出値（出力電圧）は高くなる。その検出値（出力電圧）が制御部ＣＯＮＴに送られる。

【００４３】制御部ＣＯＮＴは、所定の反射濃度基準値（所定の基準電圧）とセンサ６の検出値（出力電圧）とを比較する。検出値（出力電圧）が所定の基準値（所定の基準電圧）より低いとき、前記濃度検出用トナー像は適正濃度のトナー像より濃度が高いと判断し、換言すれば現像剤Ｄ中の荷電制御剤の濃度が低くすぎて現像量が多くなっていると判断し（図３参照）、荷電制御剤供給装置４７に信号を送り、該装置４７から荷電制御剤を液体現像剤Ｄに供給させる。これにより、現像剤Ｄ中の荷電制御剤の濃度が上昇し、現像に供される現像剤Ｄによる現像量が減少する。また、センサ６の検出値（出力電圧）が所定の基準値（所定の基準電圧）より高いとき、前記濃度検出用トナー像は適正濃度のトナー像より濃度が低いと判断し、換言すれば現像剤Ｄ中の荷電制御剤の濃度が高すぎて現像量が少なくなっていると判断し（図３参照）、キャリア液供給装置４８からキャリア液を液体現像剤Ｄに供給させる。これにより、現像剤Ｄ中の荷電制御剤の濃度が低くなる。これら操作によって、現像剤Ｄ中の荷電制御剤を適正な濃度に維持する。

【００４４】なお、ここでの制御は黒トナーを用いた濃度検出用トナー像に基づいて行ったが、この濃度検出用トナー像をイエロートナーのようなカラートナーにより形成すると、感光体の正反射特性が強いことから、該トナー像のトナー量が多いとき、すなわちトナー濃度が高いとき、散乱光強度の寄与が大きく、反射光量が多くなり、ひいてはセンサ６の検出値（出力電圧）が高くなる。従ってこのようなトナーを採用するときは、所定の基準値（所定の基準電圧）に対するセンサ６の検出値（出力電圧）に基づく荷電制御剤濃度の制御は前記と逆にすればよい。

【００４５】液体現像剤Ｄ中のトナーの濃度を制御する場合、液体現像剤Ｄの光透過性を検出する。この検出は透過型光センサ４９により定期的に行われる。液体現像剤Ｄ中のトナー濃度と透過型光センサ４９の検出値（出力電圧）とは反比例の関係にある。すなわち、現像剤Ｄ中のトナーの濃度が高いとき、センサ４９の発光部４９ａから発せられて受光部４９ｂで受光される光量は小さく、センサ４９の検出値（出力電圧）は低くなり、反対にトナー濃度が低いときセンサ４９の検出値（出力電圧）は高くなる。その検出値（出力電圧）は制御部ＣＯＮＴに送られる。

【００４６】制御部ＣＯＮＴは、前記所定の透過濃度基準値（所定の基準電圧）とセンサ４９の検出値（出力電圧）とを比較する。検出値（出力電圧）が所定の基準値（所定の基準電圧）より高いとき、液体現像剤Ｄ中のトナーの濃度は適正濃度より低いと判断し、コンク液供給装置４６に信号を送り、トナーを液体現像剤Ｄに供給させる。これにより、現像剤Ｄ中のトナー濃度が上昇する。また、検出値（出力電圧）が所定の基準値（所定の基準電圧）より低いとき、液体現像剤Ｄ中のトナーの濃度は適正濃度より高いと判断し、キャリア液供給装置４８からキャリア液を供給させる。これにより、現像剤Ｄ

中のトナーの濃度が低下する。これらによって、現像剤Ｄ中のトナー濃度が適正に維持される。

【００４７】また、制御部ＣＯＮＴは、液体現像装置４が現像を行っている間、ポンプ４４に信号を送り現像剤供給装置４００と現像装置４間において液体現像剤Ｄを循環させる。以上説明した画像形成装置によると、感光体１上に形成される光学的反射濃度検出用トナー像の濃度が反射型光センサ６によって検出され、制御部ＣＯＮＴは、該検出によるトナー像濃度に基づいて液体現像剤Ｄ中の荷電制御剤の濃度を適正濃度に保つように制御する。従って、従来のように液体現像剤中に電極を設けて導電率を測定することで荷電制御剤濃度を求める場合のように該電極へのトナー付着を取り除くための特別な手段やメンテナンスを必要とすることなく、荷電制御剤の濃度を正確に検出でき、それにより荷電制御剤の濃度を適正に維持して良好な画像を安定的に得ることができる。

【００４８】図６は、本発明の他の実施形態である画像形成装置の概略構成を示す図である。図６に示す画像形成装置は、図１に示す画像形成装置において感光体１上に形成した光学的反射濃度検出用トナー像を記録紙Ｓ上に形成するようにし、反射型光センサ６を該トナー像の濃度を検出できる位置に設けたものである。他の点は図１の装置と同様であり、同じ部品には同じ参照符号を付してある。

【００４９】この画像形成装置では、反射型光センサ６を記録紙Ｓの表面移動方向において転写部Ｐより下流側でガイド板１２ａの左側において記録紙Ｓの移動通路に臨ませた。この反射型光センサ６も制御部ＣＯＮＴに接続されている。反射型光センサ６の発光部６ａと受光部６ｂはそれぞれガイド板１２ａに向けられ、ガイド板１２ａを通過する記録紙Ｓに形成される光学的反射濃度検出用トナー像の濃度を検出できる。また、制御部ＣＯＮＴはここでは、反射型光センサ６による濃度検出タイミング制御を記録紙Ｓ上に形成されるトナー像濃度の検出タイミングに変更してある。

【００５０】この画像形成装置においても、図１の画像形成装置におけると同様に、反射型光センサ６によって記録紙Ｓ上に形成される光学的反射濃度検出用トナー像の濃度を検出し、制御部ＣＯＮＴは、該検出によるトナー像濃度に基づいて液体現像剤Ｄ中の荷電制御剤の濃度を適正濃度に保つように制御する。従って、従来のように荷電制御剤濃度測定のために液体現像剤中に電極を設けて導電率を測定する場合のように該電極へのトナー付着を取り除くための特別な手段やメンテナンスを必要とすることなく、荷電制御剤の濃度を正確に検出でき、それにより荷電制御剤の濃度を適正に維持して良好な画像を安定的に得ることができる。

【００５１】また、この画像形成装置においても、転写方式はトナー像を一旦転写ドラムや転写ベルト等の中間転写体に１次転写した後、記録材に転写する、いわゆる中間転写方式などを用いてもよい。この場合、反射型光センサ６は中間転写体上に形成される光学的反射濃度検出用トナー像の濃度を検出するように設置すればよい。

【００５２】

【発明の効果】本発明によると、静電潜像担持体上に形成される静電潜像をキャリア液中にトナー粒子及び該トナー粒子に電荷を付与するための荷電制御剤を含む液体現像剤を用いて現像する画像形成装置であって、荷電制御剤の濃度を検出するにあたり従来のように液体現像剤中に電極を設けて導電率を測定する場合のように電極へのトナー付着を取り除くための特別な手段やメンテナンスを必要とすることなく、荷電制御剤の濃度を正確に検出でき、それにより荷電制御剤の濃度を適正に維持して良好な画像を安定的に得ることができる画像形成装置を提供することができる。

【図面の簡単な説明】

【図１】本発明の１実施形態である画像形成装置の概略構成を示す図である。

【図２】液体現像剤中のトナーの濃度と該液体現像剤による現像量との関係を示す図である。

【図３】液体現像剤中の荷電制御剤の濃度と該液体現像剤による現像量との関係を示す図である。

【図４】図１に示す画像形成装置における荷電制御剤濃度制御等のための制御回路の概略を示すブロック図である。

【図５】図１に示す画像形成装置に設けられた現像剤供給装置の構造をより詳しく示す図である。

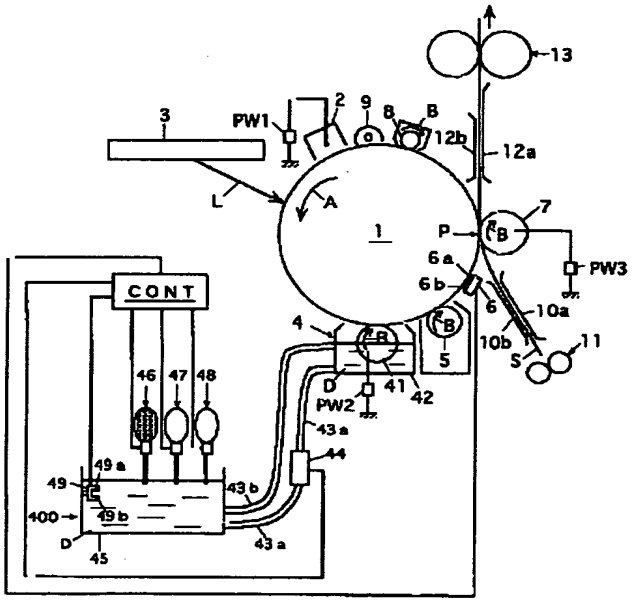
【図６】本発明の他の実施形態である画像形成装置の概略構成を示す図である。

【符号の説明】

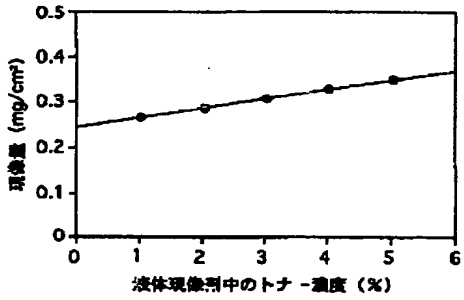
１　感光体（静電潜像担持体）
２　帯電装置
３　露光装置
４　液体現像装置
４１　現像ローラ
４２　現像剤槽
Ｄ　液体現像剤
５　スクイーズローラ
６　反射型光センサ（光学的反射濃度検出手段）
６ａ　反射型光センサの発光部
６ｂ　反射型光センサの受光部
７　転写ローラ
８　クリーナ
９　イレーサランプ
Ｐ　転写部
１０ａ、１０ｂ、１２ａ、１２ｂ　ガイド板
１１　タイミングローラ対
１３　定着器
ＰＷ１、ＰＷ２、ＰＷ３　電源

Ｌ　レーザ光
Ｓ　記録紙
４００　現像剤供給装置
４３ａ　現像剤供給用チューブ
４３ｂ　現像剤循環用チューブ
４４　ポンプ
４５　現像剤タンク
４６　コンク液供給装置
４６ａ　コンク液タンク
４６ｂ　コンク液供給部（ポンプ）
４６ｃ　コンク液ノズル
４７　荷電制御剤供給装置
４７ａ　荷電制御剤タンク
４７ｂ　荷電制御剤供給部（ポンプ）
４７ｃ　荷電制御剤ノズル
４８　キャリア液供給装置
４８ａ　キャリア液タンク
４８ｂ　キャリア液供給部（ポンプ）
４８ｃ　キャリア液ノズル
４９　透過型光センサ
４９ａ　透過型光センサの発光部
４９ｂ　透過型光センサの受光部
４９ｃ　センサ支持部材
ＣＯＮＴ　制御部

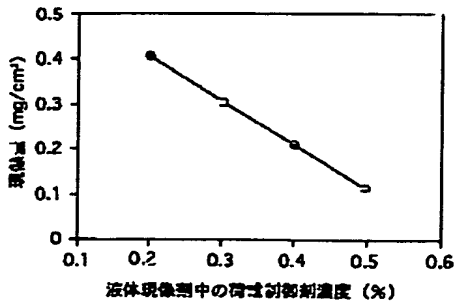
【図１】



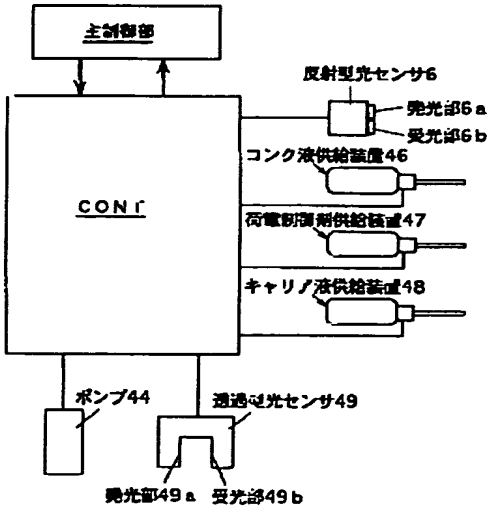
【図２】



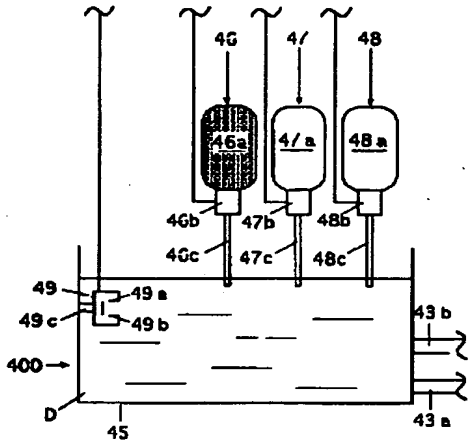
【図３】



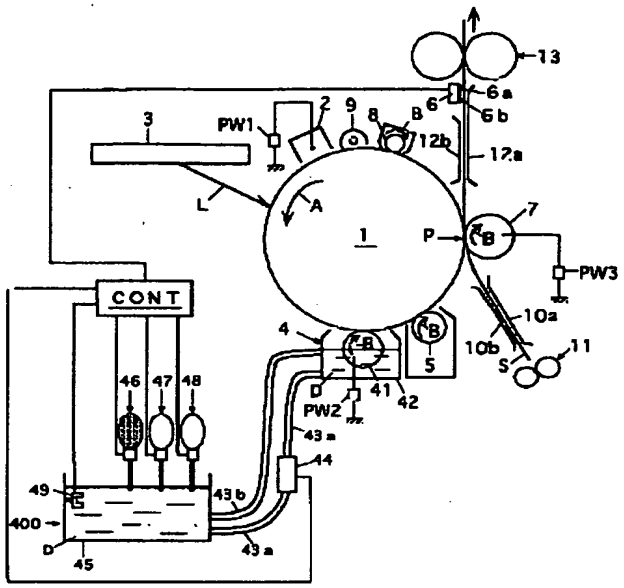
【図４】



【図5】


46
47
48
46a
47a
48a
46b
47b
48b
46c
47c
48c
49
49a
49b
49c
400
D
45
43b
43a

【図6】


13
6a
6b
6
3
PW1
2
9
8
B
12b
12a
L
A
1
P
7
PW3
CONT
10a
10b
S
11
4
5
41
42
D
PW2
46
47
48
43a
44
49
43b
400
D
45
43a